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ABSTRACT

Cognitive style is an important variable that can affect the educational process in several ways. This study, a continuation of previous research, considers two learning styles--field dependent (FD) and field independent (FI). FD learners are attuned to social interaction; they favor structure, teacher direction, and feedback; and they benefit from instruction in problem solving. FI learners are task-oriented, set self-regulated goals, seek less guidance in problem solving, and prefer to work individually. The Group Embedded Figures Test (Witkin) was administered to 65 education majors in all sections of a freshman level education course. The test was repeated as the same students completed internships during their senior year. Course grades were also collected in six required education courses. Results suggest that students who are FD during their first education course tend to become more FI by the end of the internship experience; students who are successful academically in one area of interest will generally be successful in other academic areas; students who possess characteristics of both FD and FI learners are more likely to earn better grades. Males tend to be more FI than females, but females out-perform males academically. (Contains 18 references.) (LL)

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# CONVERGENCE OR DIVERGENCE? PERSPECTIVES ON EXPERIENCE AND COGNITIVE STYLES OF PROSPECTIVE TEACHERS

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## Convergence or Divergence? Perspectives on Experience and Cognitive Styles of Prospective Teachers

Cognitive style refers to preferred perceptual style of the learner in responding to the environment. Witkin (1973) categorized styles as field-dependent (FD) and field-independent (FI). FD learners are attuned to learning and retaining social information; they enjoy social interaction and favor structure; they seek teacher direction and feedback and are affected by criticism; they benefit from instruction in problem solving. FI learners, on the other hand, are task-oriented and set self-regulated goals; they tend to organize and analyze a plan independently of the teacher; they seek less guidance in problem solving than do FD learners. They prefer to work individually and they are affected less by criticism than are FD learners (Piotrowski, 1984; Witkin, Moore, Goodenough, & Cox, 1977). FI learners prefer relatively impersonal situations and maintain greater psychological and personal space from others than do FD learners (Greene, 1976). Males tend to be more field-independent than females, although it is unknown if cultural differences are involved (Fritz, 1990; Sigel & Brodzinsky, 1977). It appears that cognitive style remains somewhat fixed, even as maturational changes occur (Witkin, 1976).

Research indicates that cognitive style is an important variable that can affect the educational process in several ways.

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It can affect students' vocational choices and academic preferences (Highhouse & Doverspike, 1987; Koroluk, 1987); it can affect students' academic performance (Canfield, 1988; Matthews, 1991; Wieseman, Portis, & Simpson, 1992a, 1992b; 1992c); it can affect teaching style and teacher-student interaction (Ramirez & Castenada, 1974; Witkin, 1973; 1976); it can affect teachers' modes of presentation (Battle & Fabick, 1975).

## Purpose

The current study is a continuation of previous research examining cognitive styles of education majors at a southern university. The initial study identified cognitive styles of students enrolled in an introduction to education course through administration of the Group Embedded Figures Test (GEFT) (Oltman, Raskin, & Witkin, 1971). The second study investigated the correlation between cognitive style and course grades, and the third study investigated grades of these subjects across five general studies courses. The purpose of the current investigation is to examine cognitive styles of 65 students over a two-to-three year span of time culminating in the internship experience. The hypothesis of the study is that scores on the GEFT following the internship will tend to be more field independent.

## Method

The researchers administered the Group Embedded Figures Test during part of one class session in every section of a freshman

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level introduction to education course for two academic years (1989-90 and 1990-91). The test was repeated as the same students completed their internship during the senior year. Course grades were also collected for the students in six courses required of all undergraduate education majors at a southern university.

## Subjects

The subjects were students enrolled in a freshman level introductory education course at a southern university. Data from 537 students enrolled in the course were collected, and results from that study are reported in Wieseman, Portis, and Simpson (1992a). The same students are being retested at the completion of the internship. This research reports the retesting of the students who completed their internship in spring and fall of 1992. Data were collected from 65 students. The researchers plan to collect data from the other students as they complete the internship. Fifty-nine students were female and six were male.

## Results

Initial and post field-dependent/independent scores, course grades from six courses, and gender were collected for all subjects in the study. The means and standard deviations for the field-dependent/independent scores are reported by gender in Table 1.

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Insert Table 1 about here

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The mean field-dependent/independent scores for all students and both females and males were higher during the internship. Scores on the Group Embedded Figures Test range from 0 to 18. Higher scores indicate independent learners and lower scores are indicative of dependent learners. Higher mean scores during internship suggest that education students became more independent learners as they progressed through the teacher-preparation program. There was a significant difference ($T = -2.26$, $p = 0.03$) between the female and males students on the initial testing; however, there was not a significant difference at the completion of the internship.

The box plot is another technique for examining the central tendencies of data. The box plot represents the range of scores from the third quartile (presented at the top of the box), and the first quartile score (presented at the bottom of the box). The middle quartile (group median) is reported with a line and the mean score is reported with an asterisk. The graphic representation of the middle 50% of the students is shown in the box. The box plots for the field-dependent/independent scores by gender for the initial and intern testing are reported in Figure 1. The box plot further illustrates the tendency for the students to have higher scores at the completion of the internship, thus indicating the students became more field-independent.

Insert Figure 1 about here

Course grades were collected for the 65 students in six courses required of all undergraduate education majors. The courses selected were introduction to education (FED 104, Introduction of Professional Education); history (HY 102, World History); English (EH 102, English Composition II); biology (BI 101, Principles of Biology); speech (COM 101, Introduction to Human Communication); and fine arts (one of the appreciation or history courses in one of the arts). The means and standard deviations for the course grades along with T Test results are reported by gender in Table 2.

Insert Table 2 about here

Female students had higher course grade means than males for all six courses. Comparison between the grades of male and female students in each course produced T scores that were not statistically significant. Students enrolled in the internship are awarded satisfactory/unsatisfactory grades and not traditional letter grades; for this reason intern grades are not reported. Students tended to have higher grades in FED 104 and lower grades in HY 102. One student did not have a fine arts grade on the

transcript, so the total number and number of female subjects in this category are different from the other courses.

The course grades, initial and intern field-dependent/independent scores, were analyzed by calculating the Pearson Correlation Coefficients. The relationship between the student scores and grades in the six courses are reported in Table 3.

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Insert Table 3 about here

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Significant correlations indicate the null hypothesis that the correlations equal zero must be rejected and we conclude there was a strong relationship. The significant correlations between the initial and intern embedded figures scores indicate that students tended to follow the similar patterns on both testings. The initial embedded figures scores were found to be significantly correlated to the grades received in FED 104, which agrees with earlier findings involving data from all students tested in FED 104. Significant correlations were not reported between the intern embedded figures scores and grades in the six courses, which suggests that response patterns were not similar for the six comparisons. Significance was found between grades in the following courses:

FED 104 and HY 102, BI 101.

HY 102 and EH 102, BI 101, COM 101.

EH 102 and BI 101, COM 101, Fine Arts.

BI 101 and COM 101, Fine Arts.

This finding suggests that the grades received by students in these courses followed similar patterns.

A difference score was calculated comparing course grades in the six courses two at a time. The difference scores and T Test are reported in Table 4. The courses listed second were subtracted from the courses listed first. Thus, positive mean difference scores indicate the larger grade was received in the course listed first.

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Insert Table 4 about here

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Significant mean difference scores were found between FED 104 and each of the other courses. The positive mean scores also indicate the FED 104 course grades were generally higher than the course grades in the other five courses. Significant mean difference scores were also found between each of HY 102, EH 102, BI 101 and COM 101, as well as between each of EH 102, BI 101 and Fine Arts.

The course grades and embedded figures scores for the interns were further analyzed by Analysis of Variance (ANOVA). A factorial ANOVA was calculated by partitioning the course grades and intern scores for each of the six courses. ANOVA results plus group means

and standard deviations are reported in Table 5.

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Insert Table 5 about here

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While some differences exist between the mean field-dependent/independent scores for students receiving various grades in each of the six courses, these differences were not sufficiently large enough to indicate significant differences. The distribution of course grades in all of the six courses reflect some variability, but most students received course grades of As and Bs with some Cs and even fewer Ds. There was an absence of Fs. The students involved in this study were screened twice, before admission into Professional Education and before admission into Internship. Therefore, students not maintaining a 2.50 GPA are screened out of the School of Education.

Further analysis of the relationships between field-dependence/independence and course grades was achieved through the construction of expectancy tables. The initial and intern group embedded figures scores were averaged for each student. Both scores are measures of field-dependence/independence, so an average of the two scores would also describe this attribute. The average group embedded figures scores were then sorted into three groups, 0-5 (low), 6-12 (middle), and 13-18 (high). The distribution of course grades for each of the three

groups are reported in Table 6.

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Insert Table 6 about here

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Chi-square analysis seems appropriate for such data; however, chi-square analysis is not a valid test when data cells have expected values less than 5. Seventeen percent (17%) of the students had mean embedded figures scores in the 0-5 category, 48% in the 6-12 category, and 35% were in the 13-18 category. Expectancy tables were examined for the course grades. The percent of students in the three categories earning course grades of As, Bs, and Cs are reported in Tables 7, 8, and 9.

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Insert Tables 7, 8, and 9 about here

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Students with mean group embedded figures scores in the middle category of 6-12 were more likely to receive course grades of A, B, or C in the six courses. The distribution of the three course grades matches very closely the distribution of students in the three categories. This finding agrees with the previous analysis where no significant difference was found in the factorial ANOVA where course grades and field-dependence/independence were analyzed.

Finally, the initial and the intern measures of

field-dependence/independence were compared. The mean initial group embedded figures score was 9.68, and the mean intern score was 11.49. Thus, as students matriculate through the teacher-preparation program, they tend to become more field-independent. Forty of the 65 students had higher intern scores than initial scores. Regression analysis indicated the initial scores were good predictors of the intern scores ($R^2 = 0.49$). The T Test comparing the intern and initial scores resulted in a value of 3.95 ($p = 0.0002$).

## Discussion

The results of this investigation indicate that education majors who are field-dependent, identified through scores on the Group Embedded Figures Test during their first education course, tend to become more field-independent by the end of their internship experiences. This finding differs from that of Witkin (1976). Initial scores appear to be good predictors of scores on the post test.

Males tend to be more field-independent than females, although females performed better academically across curricula. A surprising finding to the investigators was that grades (Tables 7, 8, and 9) in all courses examined indicate students scoring in the middle category (6-12) on the GEFT were more likely to make A, B, and C than students falling in the high (13-18) and low (0-5) categories. Significant correlations existing between grades among

courses (Table 3) suggest that grades follow similar patterns.

## Further Research

The present study indicates to the researchers three more areas in which further research needs to be done to enhance the present results. The first area is to continue the follow-up study of the students who were initially tested so that the number of students tested the second time would increase and add more power to the results.

The second area for further research is to break out the students tested into their respective majors since research indicates that cognitive style influences vocational choice and academic performance. For example, are Mathematics Education majors more field-independent than Social Science Education majors or Elementary Education majors?

The third area for further study is a close examination of the match-mismatch of students and instructors' cognitive styles. Research has indicated that this match-mismatch issue may be another factor in the determination of student performance.

## Conclusion

In summing up the current research, several significant points emerged. 1. Students who are successful academically in one area of interest will generally be successful in other academic areas. 2. Students who possess characteristics of both the field-dependent and field-independent learners are more likely to make

the A, B, and C grades. 3. Males tend to be more field-independent than females, but females out-perform males academically. 4. Education majors who are academically successful in their college career tend to become more field-independent during their college career.

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Table 1

Mean and Standard Deviation Field Dependent/Independent Scores by Gender

| Group | N | % | Mean | SD | T | P |
|---|---|---|---|---|---|---|
| Initial Scores | | | | | | |
| All Students | 65 | 100 | 9.68 | 4.87 | -2.26* | 0.03 |
| Female | 59 | 91 | 9.25 | 4.78 | | |
| Male | 6 | 9 | 13.83 | 3.97 | | |
| Intern Scores | | | | | | |
| All Students | 65 | 100 | 11.49 | 4.69 | -1.67 | 0.10 |
| Female | 59 | 91 | 11.19 | 4.65 | | |
| Male | 6 | 9 | 14.50 | 4.32 | | |

Figure 1

Box Plot by Gender of Group Embedded Figures Scores

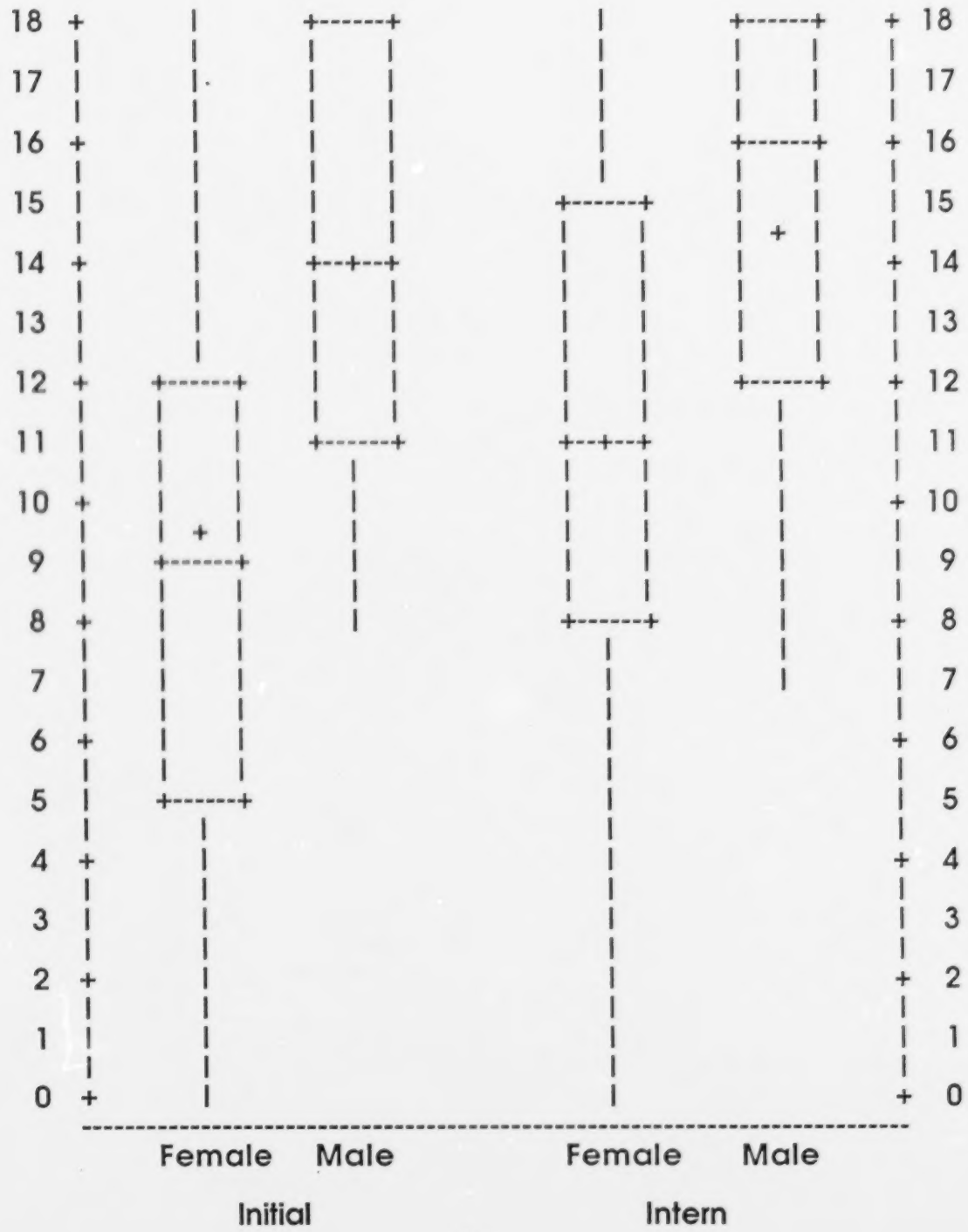

Table 2

MEAN AND STANDARD DEVIATION OF COURSE GRADE BY GENDER
And T Test

| COURSE | N | Mean | SD | T | p |
|---|---|---|---|---|---|
| FED 104 | 65 | 3.57 | 0.61 | 0.29 | 0.77 |
| Female | 59 | 3.58 | 0.62 | | |
| Male | 6 | 3.50 | 0.55 | | |
| HY 102 | 65 | 2.88 | 0.89 | 0.60 | 0.55 |
| Female | 59 | 2.90 | 0.86 | | |
| Male | 6 | 2.67 | 1.21 | | |
| EH 102 | 65 | 3.05 | 0.72 | 0.76 | 0.45 |
| Female | 59 | 3.07 | 0.72 | | |
| Male | 6 | 2.83 | 0.75 | | |
| BI 101 | 65 | 2.91 | 0.95 | 0.65 | 0.52 |
| Female | 59 | 2.93 | 0.94 | | |
| Male | 6 | 2.67 | 1.03 | | |
| COM 101 | 65 | 3.28 | 0.67 | 1.06 | 0.29 |
| Female | 59 | 3.31 | 0.65 | | |
| Male | 6 | 3.00 | 0.89 | | |
| Fine Arts | 64 | 3.38 | 0.75 | 1.30 | 0.19 |
| Female | 58 | 3.41 | 0.75 | | |
| Male | 6 | 3.00 | 0.63 | | |

Table 3

Correlation of Course Grades and Group Embedded Figures Scores

| Courses | Initial | Intern | FED 104 | HY 102 | EH 102 | BI 101 | COM 101 | Fine Arts |
|---|---|---|---|---|---|---|---|---|
| Initial | | 0.70*<br>0.0001 | 0.26*<br>0.04 | -0.12 | 0.009 | 0.02 | -0.12 | 0.03 |
| Intern | | | 0.15 | -0.16 | -0.04 | -0.05 | -0.11 | -0.02 |
| FED 104 | | | | 0.24*<br>0.05 | 0.15 | 0.31*<br>0.05 | 0.18 | 0.17 |
| HY 102 | | | | | 0.47*<br>0.0001 | 0.41*<br>0.0007 | 0.47*<br>0.0001 | 0.12 |
| EH 102 | | | | | | 0.40*<br>0.001 | 0.39*<br>0.001 | 0.26*<br>0.04 |
| BI 101 | | | | | | | 0.46*<br>0.0001 | 0.31*<br>0.01 |
| COM 101 | | | | | | | | 0.20 |
| Fine Arts | | | | | | | | |

Table 4

Mean Difference Scores For Course Grades and T Test

| Courses | | Mean | SD | T | p |
|---|---|---|---|---|---|
| FED 104 | - HY 102 | 0.69 | 0.95 | 5.87* | 0.0001 |
| | - EH 102 | 0.52 | 0.87 | 4.86* | 0.0001 |
| | - BI 101 | 0.66 | 0.96 | 5.58* | 0.0001 |
| | - COM 101 | 0.29 | 0.82 | 2.86* | 0.006 |
| | - Fine Arts | 0.22 | 0.86 | 2.03* | 0.05 |
| HY102 | - EH 102 | -0.17 | 0.84 | -1.62 | |
| | - BI 101 | -0.03 | 1.00 | -0.25 | |
| | - COM 101 | -0.40 | 0.83 | -3.91* | 0.0002 |
| | - Fine Arts | -0.5 | 1.10 | -3.64* | 0.0005 |
| EH 102 | - BI 101 | 0.14 | 0.93 | 1.20 | |
| | - COM 101 | -0.23 | 0.77 | -2.43* | 0.02 |
| | - Fine Arts | -0.33 | 0.89 | -2.94* | 0.005 |
| BI 101 | - COM 101 | -0.37 | 0.88 | -3.40* | 0.001 |
| | - Fine Arts | -0.45 | 1.01 | -3.60* | 0.0006 |
| COM 101 | - Fine Arts | -0.09 | 0.90 | -0.83 | |

Table 5

Comparison of Course Grades by Intern Embedded Figures Scores

| Course | Grade | N | Mean | SD | DF | F Value | P |
|---|---|---|---|---|---|---|---|
| FED 104 | | | | | 2,62 | 1.22 | 0.30 |
| | A | 41 | 11.83 | 4.56 | | | |
| | B | 20 | 11.50 | 4.07 | | | |
| | C | 4 | 8.00 | 8.29 | | | |
| HY 102 | | | | | 3,61 | 0.61 | 0.61 |
| | A | 19 | 10.53 | 4.60 | | | |
| | B | 22 | 11.27 | 5.05 | | | |
| | C | 21 | 12.48 | 4.51 | | | |
| | D | 3 | 12.33 | 4.51 | | | |
| EH 102 | | | | | 2,62 | 0.44 | 0.64 |
| | A | 18 | 10.78 | 4.12 | | | |
| | B | 32 | 12.03 | 4.84 | | | |
| | C | 15 | 11.20 | 5.14 | | | |
| BI 101 | | | | | 3,61 | 0.55 | 0.65 |
| | A | 21 | 11.33 | 4.32 | | | |
| | B | 22 | 10.91 | 5.42 | | | |
| | C | 17 | 12.71 | 4.63 | | | |
| | D | 5 | 10.60 | 2.97 | | | |
| COM 101 | | | | | 2,62 | 0.73 | 0.49 |
| | A | 26 | 10.65 | 4.77 | | | |
| | B | 31 | 12.16 | 4.77 | | | |
| | C | 8 | 11.63 | 4.17 | | | |
| Fine Arts | | | | | 3,60 | 0.34 | 0.79 |
| | A | 33 | 11.39 | 4.59 | | | |
| | B | 23 | 12.09 | 4.79 | | | |
| | C | 7 | 12.14 | 3.48 | | | |
| | D | 1 | 8.00 | | | | |

Table 6

Course Grades By Embedded Figures Grouping

| Course | Group | A | B | C | D | N |
|---|---|---|---|---|---|---|
| FED 104 | | | | | | |
| | 0 - 5 | 6 (55%) | 3 (27%) | 2 (18%) | 0 | 11 |
| | 6 - 12 | 18 (58%) | 12 (39%) | 1 ( 3%) | 0 | 31 |
| | 13 - 18 | 17 (74%) | 5 (22%) | 1 ( 4%) | 0 | 23 |
| HY 102 | | | | | | |
| | 0 - 5 | 4 (36%) | 5 (45%) | 2 (18%) | 0 | 11 |
| | 6 - 12 | 10 (32%) | 9 (29%) | 11 (35%) | 1 ( 3%) | 31 |
| | 13 - 18 | 5 (22%) | 8 (35%) | 8 (35%) | 2 ( 9%) | 23 |
| EH 102 | | | | | | |
| | 0 - 5 | 3 (27%) | 5 (45%) | 3 (27%) | 0 | 11 |
| | 6 - 12 | 10 (32%) | 15 (48%) | 6 (19%) | 0 | 31 |
| | 13 - 18 | 5 (22%) | 12 (52%) | 6 (26%) | 0 | 23 |
| BI 101 | | | | | | |
| | 0 - 5 | 3 (27%) | 6 (55%) | 2 (18%) | 0 | 11 |
| | 6 - 12 | 10 (32%) | 9 (29%) | 8 (26%) | 4 (13%) | 31 |
| | 13 - 18 | 8 (35%) | 7 (30%) | 7 (30%) | 1 ( 4%) | 23 |
| COM 101 | | | | | | |
| | 0 - 5 | 6 (55%) | 4 (36%) | 1 ( 9%) | 0 | 11 |
| | 6 - 12 | 13 (42%) | 13 (42%) | 5 (16%) | 0 | 31 |
| | 13 - 18 | 7 (30%) | 14 (61%) | 2 ( 9%) | 0 | 23 |
| Fine Arts | | | | | | |
| | 0 - 5 | 6 (60%) | 3 (30%) | 1 (10%) | 0 | 10 |
| | 6 - 12 | 16 (52%) | 11 (35%) | 3 (10%) | 1 ( 3%) | 31 |
| | 13 - 18 | 11 (48%) | 9 (39%) | 3 (13%) | 0 | 23 |

Table 7

Number and Percent of Students Receiving
Course Grade of A By Category

| Course | 0 - 5 | 6 - 12 | 13 - 18 | N |
|---|---|---|---|---|
| FED 104 | 6 (15%) | 18 (44%) | 17 (42%) | 41 |
| HY 102 | 4 (21%) | 10 (53%) | 5 (26%) | 19 |
| EH 102 | 3 (17%) | 10 (56%) | 5 (28%) | 18 |
| BI 101 | 3 (14%) | 10 (48%) | 8 (38%) | 21 |
| COM 101 | 6 (23%) | 13 (50%) | 7 (27%) | 26 |
| Fine Arts | 6 (18%) | 16 (48%) | 11 (33%) | 33 |
| TOTAL | 28 (18%) | 77 (49%) | 53 (34%) | 158 |

Table 8

Number and Percent of Students Receiving
Course Grade of B By Category

| Course | 0 - 5 | 6 - 12 | 13 - 18 | N |
|---|---|---|---|---|
| FED 104 | 3 (15%) | 12 (60%) | 5 (25%) | 20 |
| HY 102 | 5 (23%) | 9 (41%) | 8 (36%) | 22 |
| EH 102 | 5 (16%) | 15 (47%) | 12 (38%) | 32 |
| BI 101 | 6 (27%) | 9 (41%) | 7 (32%) | 22 |
| COM 101 | 4 (13%) | 13 (42%) | 14 (45%) | 31 |
| Fine Arts | 3 (13%) | 11 (48%) | 9 (39%) | 23 |
| TOTAL | 26 (17%) | 69 (46%) | 55 (37%) | 150 |

Table 9

Number and Percent of Students Receiving
Course Grade of C By Category

| Course | 0 - 5 | 6 - 12 | 13 - 18 | N |
|---|---|---|---|---|
| FED 104 | 2 (50%) | 1 (25%) | 1 (25%) | 4 |
| HY 102 | 2 (10%) | 11 (52%) | 8 (38%) | 21 |
| EH 102 | 3 (20%) | 6 (40%) | 6 (40%) | 15 |
| BI 101 | 2 (12%) | 8 (47%) | 7 (41%) | 17 |
| COM 101 | 1 (13%) | 5 (63%) | 2 (25%) | 8 |
| Fine Arts | 1 (14%) | 3 (43%) | 3 (43%) | 7 |
| TOTAL | 11 (15%) | 34 (47%) | 27 (38%) | 72 |